The Sounds of Music: Modal Ethos in *Problemata* 19.48

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1. The Problem and a Dubious Solution

In *Pr*. 19.48 we read, in Mayhew's translation,[1] the following:

> Why do choruses in tragedy sing neither in Hypodorian nor in Hypophrygian? Is it because these *harmoniai* have the least melody, which is most necessary to the chorus? Now the Hypophrygian has a character of action, and this is why in the *Geryone* the marching out and the arming (*episodes*) are composed in this manner, while the Hypodorian has a magnificent and steadfast character, and this is why of the *harmoniai* it is most suited to kithara song. But these (*harmoniai*) are both inappropriate to the chorus, and more suitable to the (*actors*) on the stage. For the latter are imitators of heroes; but in the old days the (*chorus*) leaders alone were heroes, while the people, of whom the chorus consists, were humans. And this is why a mournful and quiet character and melody are appropriate to it; for (*the chorus*) is human. Now the other *harmoniai* have these,[2] but the Phrygian has them least, since it is inspirational and Bacchic, (*and the Mixolydian certainly has them most of all*).[3] Under the influence of this (*harmonia*),[4] therefore, we are affected in a certain way; and the weak are affected more than the strong, which is why even this one is appropriate to choruses; but under the influence of the Hypodorian and Hypophrygian we act, which is

[1]Mayhew (2011, 577 & 579, and notes 119-22).

[2]I.e., the harmonies that are neither Hypodorian nor Hypophrygian have the characteristics appropriate to the chorus. [Mayhew's note.]

[3]There is likely a gap in the text here. The phrase I add is based on Gaza's translation. The author may have gone on to say more about why the Mixolydian harmony (on which see *Pol*. 1340b1) has these characteristics most of all. [Mayhew's note.]

[4]The author seems to be referring to the Phrygian, not the Mixolydian, harmony. [Mayhew's note.]

> not suitable to a chorus. For the chorus is an inactive attendant, since it merely offers goodwill to those who are present (*on the stage*).

This passage is a classic expression of the well-known but still obscure facts alleged about music and its moral or emotional effects by Plato and Aristotle and by the Pythagorean tradition generally.[5] The problems these facts pose for us are basically two: what were the Greek modes and how is it that they had the moral and emotional effects, or the *ethos*, alleged? The standard way of answering these questions can nicely be illustrated from an article by Robert Wallace (2005, 148):

> It is the standard view that Damon correlated *harmoniai* with *ethos:* that is, with types of behavior and character. We find such correlations in book 3 (398c-399c) of Plato's *Republic* and many later sources. . . . How did the correlations work? It has always puzzled scholars that a shift even of one note in a scale could have produced profoundly different emotional and behavioral effects. For example, as the scales in Barker and West indicate, the Dorian *harmonia* differs from the Phrygian *harmonia* only in the last note of the scale. . . . Yet every ancient source describes these *harmoniai* as entirely different in character. . . .

So Wallace concludes (*ibid*. 155):

> [I]n Damon's period the *harmoniai* in themselves mostly did not have simple *ethos* correlations. Sad or happy or serious music could be played in any *harmonia*. . . . If [Damon] could not have categorized the *ethos* of each individual *harmonia* because that *ethos* varied from song to song, what remains are the other variable qualities of music, the

[5] For the evidence, along with informative discussion, see Barker (1984: 163-169). Barker also quotes the significant passages from Plato *Republic* 197-402, and Aristotle *Politics* 8.6-7 (1984: 128-136, 174-182). See also Lippman (1975), especially chapter 2, which is entitled 'Theories of Musical Ethos'; and West (1992: 246-253).

> *poikilia,* including pitch and tempo, *agoge,* an interest in which *Republic* 400 expressly attributes to him. . . .

Other scholars say similar things.[6] Whatever the ethos of the different modes was it could not, despite the unanimous testimony of ancient authors, have been a matter of difference in scale. It must have been a function of many other things and in the end, perhaps, just a matter of subjective preference or national prejudice.

The result of this view of Greek music is that the Greek modes cannot have had the effects alleged by Plato and Aristotle and the Pythagoreans, or that the effects were largely subjective to the Greeks of the day (or to Plato and Aristotle and Pythagoreans in particular), or that they were in fact brought about, not by the mere difference in intervals between the several modes, but by a whole range of differences extending to style, pitch, mannerisms, cultural associations, and the like. But this interpretation is not very plausible. Plato and Aristotle were hardly prey to irrational illusions; they were not modern subjectivists or caught by merely subjective phenomena; they were plainly not speaking of differences in style and mannerisms. So unless we are going to swallow these implausibilities, we should conclude that modern scholarship about the ancient Greek modes is mistaken and, indeed, that it is looking in the wrong place for

[6] See Barker as mentioned in the previous note. Also, Jan (1895) who writes in his note to *Pr*. 19.48 (p.109): "Harmoniis singulis qui fuerit ordo tonorum et semitoniorum habes in Cleonidis isagoga…; sed ad naturam illarum constituendam timeo ne plura accesserint, melodiae formae quaedam et certae versiones, quas nos plane ignoremus." ("What the order was of the tones and semitones in the individual modes you can find in Cleonides' Isagoge…; but as to the constitution of their nature, I am afraid that more things would have been added – certain forms and definite versions of melody – which we are plainly ignorant of.") Finally, Anderson (1966: 178-179) speaks of "the ethical characterization of a mode through its actual technical characteristics," but immediately adds that "[s]uch a procedure cannot of itself be associative," and continues that treating technical data "as being significantly related to ethical terms" was never warranted, and that such transference of meaning "resulted possibly from an inadequate technical grasp of music on the part of philosophers…"

answers. If the modes were anything like what Plato and Aristotle and the Pythagoreans said they were, they were not differentiated in the only ways that modern scholars speak or think of.

There is in fact an even stronger reason to reject what modern scholarship says here. For it all starts, by general confession, from the standard accounts of Greek musical theory that we get in the ancient writings on the subject. The surprise here is that these texts themselves, or rather the text to which they all go back and rely on even when they criticize it, confess ignorance of the Greek modes as they were understood in the time of Plato and Aristotle (see Wallace 2005, 147). One wonders, therefore, why modern scholars insist on using these texts as their guide. If one says that scholars have no choice, this response is first not true (the essential facts of music are not time-dependent and can be investigated with as much direct experiment now as they ever were in the past), and second it is not an answer. For if the ancient texts say they do not know what they are talking about, they give us reason to ignore them, not reason to use them.

The text to which all other texts go back is the *Harmonic Elements* of Aristoxenus (4th c. BC, student of Aristotle), the early chapters of which, at any rate, survive largely intact. These books contain a sustained attack and critique of those whom Aristoxenus calls the harmonists, or in other words the modalists (for *harmonia* is the Greek for a musical mode). Aristoxenus basically says, and several times, that these modalists did not understand the first thing about music and got just about everything wrong (*Harm*. 2.37-43, see quotes below). To correct their errors and to put the science of music on a sound footing, Aristoxenus undertakes to expound the science properly and for the first time. In other words, Aristoxenus is throwing out all the theorizing that was going on in his own day and replacing it with something new. One of the significant things about the something new he introduces is that it has no place for the modes as traditionally

understood. Indeed Aristoxenus dismisses these modes as so much confusion and even ethno-centrism, as in the following:

> *Harm*. 2.37: The exposition of the *tonoi* by the harmonicists is just like the way the days of the month are counted, where, for example, what the Corinthians call the tenth the Athenians call the fifth, and others again the eighth. (Barker 1989, 153).[7]

We ought, therefore, to conclude, and certainly scholars of ancient Greek music should conclude, that everything about Greek musical theory that comes to us from Aristoxenus is going to be of next to no help in understanding what Plato or Aristotle or Pythagoras meant. We ought, therefore, to throw out from the very start that archetypal piece of Aristoxenan musical theory, namely the division of scales into tetrachords, or rather into tetrachords that are understood as always intervals of a fourth. According to Aristoxenus the way to understand music is to understand singing, and the way to understand singing is to start with the smallest consonant interval, namely the fourth. The next consonant interval, the fifth, produces, when joined to a fourth, the final consonant interval of the octave. Actually what Aristoxenus does is to combine fourths through the interval of a tone, since a fourth plus a tone produces a fifth, and a fourth plus a tone plus a fourth produces an octave. All Aristoxenus' scales, including his equivalents of the ancient modes (for he uses the names of the modes for some of his scales), are constructed out of different kinds of tetrachords of fourths and their combinations.

[7] Since Aristoxenus was a student of Aristotle's, it may seem puzzling how he could have been so dismissive of previous musical theory and accordingly of Aristotle too. But, first, Aristoxenus seems to have been a bit of an arrogant character (Barker 2007: 136), second, directly going against one's master is something that Aristotle himself had done before, and, third, Aristotle seems to have devoted very little systematic study to the technical side of musical theory so that opposing him here may have seemed to Aristoxenus, and perhaps even to Aristotle himself, as the prerogative of the expert in face of the non-expert.

Aristoxenus's tetrachords are, as was said, intervals of a fourth, and in order for them to remain so the two notes that bound the interval must be immovable with respect to each other (for if either moved in pitch while the other did not the interval would cease to be a fourth). The two notes that are internal to the tetrachord can, however, be moved for they will not affect the overall interval of the fourth of the tetrachord. Aristoxenus' theory, therefore, consists of tetrachords composed of two immovable and two movable notes. The two movable notes produce, by moving closer to each other and to the lowest of the two immovable notes, the three kinds of tetrachord: the diatonic when these two notes are separated from each other and from the lowest note by intervals of a tone; the chromatic when they are separated by semitones; the enharmonic (that is, the modal as Aristoxenus understand modes) when they are separated by intervals of a quartertone. Aristoxenus is not precise in the way that we are about the intervals of the semitone or the tone because he allows there to be semitones and tones of different sizes. In fact he has three sizes of semitone and two sizes of tone. The result is he has six varieties in all: one size of quartertone (Aristoxenus did not allow that there could be intervals smaller than the human voice could easily sing, and the quartertone, or diesis, is the smallest such interval and cannot be divided further), three of semitone, and two of tone. Hence we get not only chromatic and diatonic tetrachords but also the soft and hemiolic and tonic chromatics, and the soft and tense diatonics which, with the single enharmonic, give six kinds in all.[8]

But all these comments are merely by way of curiosity. They have, and can have, no relevance for understanding what Plato and Aristotle and the above passage from the *Problems* meant by the modes. They only have relevance for understanding all the extant texts of Greek musical theory, every one of which follows Aristoxenus in talking about tetrachords of fourths

[8]See West's helpful summary of these points, as well as of the variants of them given by Ptolemy and Didymus (1992, 169-70).

and the division and classification of scales according to different ways of combining different kinds of tetrachord.

How and why Aristoxenus ended up inventing a theory of music based on tetrachords of fourths in this manner would make an interesting story, but essentially a useless one. The theory, while of enormous importance historically (for it influenced thinking and practice right through to the end of the middle ages), is musically arbitrary. There is no necessary reason to base scales on Aristoxenan tetrachords; there is no necessary reason to construct tetrachords downwards (as Aristoxenus does); there is no necessary reason to confine consonant intervals to fourths and fifths and octaves; there is no necessary reason to limit tones and semitones and quartertones to the few varieties that Aristoxenus allows. Of course, Aristoxenus could, and did, appeal to the limits imposed by the capacity of the human voice, but there is no necessary reason to construct music, or its theorizing, according to those limits. Our modern music has long abandoned Aristoxenus' inventions and for the most part much to the improvement of both practice and theory. Music is much richer in its possibilities than Aristoxenus allowed, although his way too is one of those possibilities which deserves its place in the sun, provided it not exclude, as Aristoxenus made it exclude, all the others.

The concern here, however, is not with Aristoxenus and his legacy, except to dismiss it from further consideration as a way to understand the modes. But since dismissing Aristoxenus means dismissing the whole of extant ancient Greek writing on music, one is forced, if one wants to find out anything about the ancient modes, to start, not with any writings (nor indeed with any of the musical scores that survive, since the interpretation of them depends on a prior interpretation of the scales they are based on), but with timeless musical facts. The question is which musical facts should these be, since there are many facts one could start with. Fortunately there is here a

modern guide we can follow instead who herself, by virtue of her extensive theoretical and practical knowledge of music and instruments as well as by a process of inspired investigation, marked out the path to follow, or at any rate the first path to follow. For even if there are other paths to follow too, there is no doubt that this path must, in many respects, be the correct one and certainly one that cannot be ignored in any attempt to understand the ancient Greek modes.

2. The Problem and a Better Solution: The Greek Modes

The guide in question is Kathleen Schlesinger in her superb and unjustly maligned book *The Greek Aulos* (1939).[9] One should begin, as she does, with certain key facts about music that, as will emerge, must have been at the origin of the Greek modes whatever else may be true of them and whatever else may still be hidden from us about them.

The facts in question are fundamentally two: first about the monochord and second about the aulos. The monochord, which is, as its name helps to indicate, an instrument of one string stretched over a sounding board, is an invention of Pythagoras for exploring musical intervals. It is still in fact an essential tool for theorizing about music and sound. Unfortunately, the way the monochord is now usually explained and used is misleading. This way consists of dividing the whole string into a series of different fractions, first that of a half, then that of a third, then that of

[9] West says of this book: "Kathleen Schlesinger wrote a massive, a terrifying book, *The Greek Aulos*, based on the belief that Greek pipes too had equidistant finger-holes. She was untroubled by the fact that this is not true of the only surviving classical auloi that she studied" (1995, 96). This remark is demonstrably false as a look at Schlesinger (1939, 97), where this very fact is noted and explained, will show. Andrew Barker (1989, 154 n.33) is also dismissive of Schlesinger, if less harshly. Barker's preference is clearly for Aristoxenus. Anderson (1966, 23-25) is more supportive, even referring to Schlesinger's theory as "uncommonly attractive." But he dismisses her ideas in part because they are "at variance with the theorists' accounts" and have "no unambiguous support from any written evidence," which, however, is precisely what one would expect if the theorists and the written evidence are all dependent, as indeed they are, on the work of Aristoxenus.

a fourth, and so on. The first division, with the string divided into two, produces, when the whole string is sounded and then half of it, the interval of an octave. The second division, with the string divided into three, produces, when the whole string is sounded and then two thirds of it, the interval of a fifth. The third division, with the string divided into four, produces, when the whole string is sounded and then three quarters of it, the interval of a fourth, and so on. Such is, of course, one way of experimenting with a monochord. The main problem is that it requires dividing and then re-dividing the whole string into several different divisions one after the other. A simpler and more obvious way of using the monochord consists in dividing the whole string only once, but dividing it into multiple equal divisions, as many as 16 or 30 or 60. One then proceeds to sound the string at the first of these divisions, say at one sixteenth of its length. Then one sounds it at two sixteenths, then at three and so on to the end. This process too produces the same intervals as before but without the need for repeated division of the string. For the second note, sounded at two sixteenths, produces, with the first note at one sixteenth, the interval of an octave; the third note produces, with the second note, the interval of a fifth; the fourth produces, with the third, the interval of a fourth; and so on. In this way one gets all the intervals simply by moving progressively down the string and so by increasing the length to be sounded by an equal increment each time.

There are two features of this way of using a monochord that deserve notice. First, one will in this way produce progressively smaller intervals in a systematic (and indefinitely extendable) series, in fact in the harmonic series; second, one will produce these intervals *downwards* and not *upwards*. The previous way of using a monochord, the standard modern way, produces the intervals upwards. But this second and simpler way cannot but produce the intervals in the opposite direction. The Greeks, we know, constructed their scales downwards, and certainly

Aristoxenus did. But there was no compelling reason for Aristoxenus to construct his intervals downwards rather than upwards. The fact that he went downwards rather than upwards is almost certainly due to the fact that previous theorists, the modalists whom he criticizes, went downwards. So Aristoxenus not unnaturally did it the same way despite, or rather because of, his criticism of them. But why did the modalists go downwards? Perhaps their practice too was arbitrary, but we should take seriously the possibility that it had a reason, the reason intrinsic to the simplest and obvious way of using the monochord (that we don't use the monochord in this simple and obvious way is no doubt because in our modern music, for historical reasons, we construct our scales upwards, and so we construct intervals on the monochord upwards too). That Pythagoras and his followers used the monochord by constructing intervals downwards can be more or less assumed, if only because it makes the whole thing simple and obvious. Constructing the intervals upwards, while possible, would not add anything to musical understanding (since everything that can be done one way can be done the other) while nevertheless adding a great deal to practical convenience.

That the modalists whom Aristoxenus criticized constructed their scales downwards we can know for certain from two facts that Aristoxenus himself reveals in his criticism of them, namely that they took their musical bearings by the aulos and that they constructed their diagrams with densely packed intervals. For, to take the second point first, if one descends down the monochord through equal increments, all the early intervals reappear but with lesser intervals between them. So the interval of the octave appears between the eighth note sounded and the fourth note sounded, but with the intervals formed by the fifth and sixth and seventh notes in between; the octave also appears between the sixteenth note sounded and the eighth note sounded, but now with lots of other intervals in between, intervals that are themselves duplicates, but lower down,

of intervals already sounded higher up. This phenomenon leaps at once to the eye, and to the ear, from the descending series of intervals on the monochord as the diagram in figure 1 below will show. It leaps even more to the eye in figure 2 below. For if one takes a monochord and marks on its sounding board the points at which the intervals for all the modes would be placed, then some of these points will be very close to each other (at intervals of very much less than a quarter tone, let alone a semi tone). So, in figure 2 below, imagine all the interval lines being extended up from each of the lower rows into the top row. The top row would then present a series of very densely packed lines.[10]

These diagrams explain at once what the modalists were likely up to, which is something Aristoxenus did not understand and dismissed as ignorance. But it was Aristoxenus who was ignorant, as the diagrams and their musical facts indicate. For even if many of the intervals one discovers on the monochord in this way are unsingable or unmelodic, as Aristoxenus complains (for Aristoxenus took his bearings in musical theory by what was singable by the human voice), they are nevertheless soundable and hearable, for the monochord will sound them. They are therefore certainly musical intervals even if they are not singable ones, and that result, as far as the modalists and the traditional modes were concerned, could well have been enough.

The second fact concerns the musical properties of the aulos (brilliantly expounded and experimentally proved by Schlesinger). For the aulos functions in effect as a wind monochord. Certainly it will function this way if one follows the easiest and most practically obvious way of

[10] The modalists whom Aristoxenus criticized were very likely drawing diagrams like figure 2. Perhaps they were even trying to detect by ear the difference between the smallest intervals to see how these small intervals could distinguish the modes. But these intervals are too small to be detected individually when ‘densely packed’. They have to be heard within their modal sequence, not across modal sequences. To this extent Aristoxenus was right in his criticisms. He was just wrong to suppose that therefore the modalists did not know what they were talking about in their diagrams, when doubtless they knew very well.

making and playing an aulos. For we must keep in mind that there was in ancient Greece, even in its most sophisticated age let alone in its more primitive ones, none of the modern techniques and machines that we now have to produce instruments of almost any dimension and divisions (and in particular to produce instruments tuned to our highly artificial and mathematically sophisticated tempered scale) The first aulos players, shepherds in the fields with their flocks, would have been reduced to the simplest of techniques. If one plays an aulos, or a simple length of reed, one will notice, if only by accident, that the reed will sound one note when blown without any holes along its length, and another note, or several notes, when it does have holes and these holes are opened and closed by the fingers. First, perhaps, the holes, if accidental, might be placed anywhere on the length of the reed and no systematic connection would be found between the notes that it sounded. But if a shepherd, idling away his time while the sheep grazed, decided to make holes for himself, how would he do so? Well, he would follow a method, and the natural and obvious method would be to place holes at equal distances from each other. He might begin with one placed at half the length of the reed and then another placed at half the length again and so on; or perhaps he might place them at a third and two thirds of the length, and then half way between these; or in other ways. We should add that the aulos is actually two reeds, the main bulk of which acts as a resonator (this part is all that survives when the remains of auloi are discovered in archaeological digs), and a smaller reed inserted into the top of it which, by the beating of the flattened edges placed in the mouth (the double reed) or by the beating of a hinged oblong tongue cut into it (the single reed), actually produces the sound. For since this smaller reed would add to the overall length of the aulos, a division of the main resonator into six, say, would actually be a division into seven if the smaller reed was equal in

length to one of those six divisions. At any rate, we can easily imagine how shepherds could produce auloi with holes in them spaced at several different series of equal intervals.

What is the musical result of an aulos so divided? The answer is that it produces notes related to each other as the notes of the monochord are when formed in descending order. If all the holes on an aulos are left open, it will sound its highest note, namely the note formed by the hole nearest the mouth. If this hole is stopped it will sound the note formed by the next hole down which, by the very nature of the case, must form with the first note (and with the other notes too) an interval that is related to it as is some numbered interval on the monochord. Let us say, for the sake of argument, that the aulos is divided into 12 equal segments with the interval numbered 12 being the fundamental note, or the note that the full length of the aulos sounds when all holes are stopped. Let us further suppose that the holes in the aulos are at the segments numbered 6 through 11. When all holes are open the sound is produced through hole 6, and this note will form with the fundamental the interval of 6 to 12 (which is an octave, 1:2). When this hole is closed the sound will be produced through hole 7, and this note will form with the note of hole 6 the interval of 7 to 6 (which is a septimal third) and with the fundamental note the interval of 7 to 12 (which is a sharpened sixth); the succeeding holes will produce notes in the intervals of 8 to 7 (the septimal tone) and 8 to 12 (the fifth, 2:3), 9 to 8 (the tone) and 9 to 12 (the fourth, 3:4), 10 to 9 (a minor tone) and 10 to 12 (the minor third, 5:6), 11 to 10 (a smaller tone) and 11 to 12 (an even smaller tone).[11] If the aulos is divided according to some other number (say 11 segments instead of 12) the intervals and divisions would be something completely different. What is important to note is that any aulos, if only it is constructed (as it almost certainly would be in primitive conditions) with holes spaced at equal divisions, would of necessity produce a series of

[11]According to Schlesinger (1939, 19-23) this mode is actually the Phrygian; see the figures below.

notes, a scale in other words, that would be related as are some or other of the intervals on a descending monochord. It just could not be otherwise.

But now what likely follows? Reeds can be found in many different places but the people who live in those places have different languages and traditions and habits and preferences. A reed with holes in it according to one set of equal divisions might produce a series of notes that would please one group of people, while a reed with holes in it according to another would please another. Accordingly reeds divided in one way would tend to dominate in one place and reeds divided in another in another. The Phrygians would have reeds and auloi constructed to produce one set of musical intervals; the Lydians another; the Dorians a third. As these groups interacted, by trade or war or chance, and compared their different auloi, they would begin to notice the differences and start referring to each others' auloi and intervals as the Phrygian way, or the Lydian way, or the Dorian way. In short they would refer to each others' scales as constructions of notes (*harmoniai*) after the Phrygian or the Lydian or the Dorian fashion (which is actually what the Greek words used for the modes—*Φρυγιστι, Λυδιστι, Δωριστι*—literally mean). Such is what, as Schlesinger first argued so well, is an ancient Greek mode, and is what Plato and Aristotle and the above *Problems* passage were talking about. A mode, therefore, has nothing to do with what Aristoxenus supposed or that any other Greek musical theorist whose works survive has bequeathed to us. We can, however, confirm, or even prove, that such is what a mode is from what Aristoxenus said in criticism of the modalists. For in his very misunderstanding he left decisive clues as to what the modalists were really doing.

To prove the points argued above it will suffice to follow Schlesinger and quote some of the passages from Aristoxenus' *Harmonic Elements* that she herself draws attention to. Everything that Aristoxenus rejects as absurd and simple-minded in the modalists is neither absurd nor

simple-minded but rather makes perfect sense when seen in the light of the facts adduced by Schlesinger.[12] This fact shows that it was not the modalists who did not understand what they were talking about but Aristoxenus who did not understand what the modalists were talking about.

> *Harm*. 2.39: As to the objective that people assign to the science called harmonics, some say that it lies in the notation of melodies, claiming that this is the limit of the comprehension of each melody, while others locate it in the study of auloi, and in the ability to say in what manner and from what origin each of the sounds emitted by the aulos arises. But to say these things is a sign of complete misunderstanding. . . . (Barker 1989, 155)
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> *Harm*. 2.41: No less absurd is the conception relating to auloi. . . . It is not because of any of the properties of instruments that harmonic attunement has the character and arrangement which it does. It is not because the aulos has finger-holes, bores, and other such things . . . that the fourth, the fifth, and the octave are concords, or that each of the other intervals has its own appropriate magnitude. . . . (157)
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> *Harm*. 2.42: If anyone imagines that because he sees that the finger-holes are the same every day . . . he will therefore find the attunement permanently fixed in them and maintaining the same organization, he is thoroughly simple-minded. (158) [13]

[12]Aristoxenus' misunderstandings could be explained, and even to some extent excused, if in his day, because of sophistications in the construction and playing of auloi (and principally the use of the single as opposed to the double reed), the holes on these auloi were no longer as reliable in giving notes in the descending harmonic series and so were no longer as reliable in preserving the structure and character of the modes. Schlesinger explains what could have been going on here in some detail in chapter two of her book.

[13] Barker briefly discusses these passages in a later work (2007: 58-60), and expressly draws attention to the fact (noted before by Schlesinger) that an aulos having holes bored at equidistant spatial intervals will produce notes at decreasing musical intervals. So he points out, for instance,

Harm. 2.43: It is clear, then, that there is no reason for basing the study of melody on the aulos, since this instrument cannot establish the true order of attunement. . . . (158)

3. The Problem and a Better Solution: The Ethos of the Modes

With this understanding of what the modes were, we can now come to the second problem mentioned at the beginning, the problem of the ethos of the modes. For if these modes are what Schlesinger says they were, and what the evidence she adduces proves they must have been, then to suppose that these modes as modes, that is, as systems of musical intervals, could have had the diverse moral and emotional effects attributed to them is perfectly plausible. Instead of the modes differing only in pitch or in order or in one or two intervals alone, they differ in everything. For if we take a string sounding some fundamental note, say F two octaves below middle C, and if we then divide it, in turn, into 9 or 10 or 11 or 12 equal divisions, we will produce a completely different series of intervals descending to that same fundamental note. Moreover, since this series will be a descending harmonic series in each case, it will have a principal note or *archē* (namely the highest note from which the series begins and so also, by derivation, from any octave interval thereof, as the fourth or the eighth or the sixteenth degree downwards) that will be located at different points in the series. If the division is by 12, this principal note, or its octave derivative, will be four degrees from the fundamental (8 from 12); if

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that an aulos with a first hole bored at 8 units from the mouthpiece, a second at 12 units, and a third at 16 units, will produce notes in the rations of 8:12 (a fifth, 2:3) and 12:16 (a fourth, 3:4), even though the spatial distance (4 units) is the same in each case. He rediscovers, so to say, Schlesinger's discovery about the modes. However, unlike her, he does not pursue the issue, because, as it seems, he is too impressed (as Aristoxenus was before him perhaps, see previous note) by the ways in which equidistant holes in an aulos can, by the use of various musical tricks (especially those introduced by the single reed), produce a variety of different notes and not merely those determined by the spacing between the holes. So he discounts the possibility that the fundamental musical significance of equal distance could be the missing clue as to what the modes were before the theorizing of Aristoxenus obscured matters.

the division is by 11 it will be three degrees; if the division is by 16 it will be eight degrees; and so on. This principal note has nothing to do with what we call the tonic of a scale. For our scales are not based on the descending harmonic series (or even on the ascending one). Moreover, the tonic in our scales is always on the same degree of the scale, namely the first note going upwards. But the principal note for the Greeks, which they called *mesē,* is not anything like our tonic and it appears at different degrees in each of the modes (as even Aristoxenus admitted).

Since, therefore, each mode will differ both in every one of its intervals and in the relative position of its principal note, each mode will be *toto caelo* different from every other. There could, therefore, be nothing surprising in modes which differ like this differing also in their ethical effect. Accordingly the assertions of Plato and Aristotle and the Pythagoreans about the extraordinarily diverse effects of the different modes can be taken at face value and do not have to be dismissed as subjective or obscure or mistaken. Schlesinger indeed herself asserts (1939, 135):

> No one who is familiar with the modal sequences of the Harmoniai in Ancient Greece remains in doubt as to the potency of this Ethos. To play a simple melodic phrase on the same degrees of each Harmonia in succession furnishes a convincing demonstration of the reality of the characteristic Ethos of the Modes.

Given the proven reliability of Schlesinger in other matters as to the Greek modes, and given her extensive experimentation with reconstructions of auloi and with monochords, we should accept the truth of her assertion. Of course, it would be nice if we could ourselves confirm what she says by doing what she did and what she recommends, namely listen to the Greek modes ourselves and in particular to a simple melodic phrase played on each mode in turn. For the question that cannot but now excite the keenest interest is precisely what the modes, as

distinguished by Schlesinger, actually sound like and how they do diversely affect us. The best method to follow here, of course, would be actually to produce instruments with intervals conforming to Schlesinger's modes and play them. Unfortunately such instruments do not to my knowledge exist and, further, none of the recordings of ancient Greek music that are currently available follow Schlesinger's discoveries. They follow rather what is found in the extant writings of Greek theorists and what modern scholars make of these writings. Hence, while they may accurately represent what some Greek music sounded like in post-Aristoxenan performance, they do not, and cannot, represent what the modes sounded like for Plato, Aristotle, the Pythagoreans, and their contemporaries.

Nevertheless we are not entirely at a loss, because we can look at and compare the modes (as reconstructed by Schlesinger) according to their individual and characteristic intervals. In the light of these intervals we can perhaps make a good guess at why they should have the ethos attributed to them.[14] Let us return then to the quotation from the *Problems* with which this paper began and look at what is there expressly attributed to the several modes.

The quotation is concerned chiefly with the Hypodorian and Hypophrygian modes and with the fact that they both have the character or ethos of action and so are suitable to the actors in tragedy but not to the chorus, which is not heroic and does not act. The other modes, and especially the Mixolydian, are said to be appropriate to the chorus by having a mournful and quiet character, save for the Phrygian which, although also appropriate in a way to the chorus, is inspirational and Bacchic.

To see how the modes could fit these descriptions consider from the following diagram how Schlesinger reconstructs them according to the descending harmonic series as based on divisions

[14] The reflections about the modes that follow are largely my own though prompted entirely by remarks by Schlesinger.

progressively from 8 to 14 (or the octave double of these in the case of the divisions from 8 to 12).[15] Notice that the note marked in **bold**, either 8 or 16, is *mesē*, or the *archē* of the mode. It is always at some octave interval from the implicit first note in any of these series, namely 1 (for the first octave from 1 in descending order is 2, the next 4, the next 8, the next 16 and so on). In deference to modern practice, the notes are arranged in ascending order of pitch from left to right, so that the lowest note in the mode is the one furthest to the left, and the highest note the one furthest to the right.

Figure 1: The modes in intervals

Mixolydian	14	13	12	11	10	9	**8**	7
Lydian	13	12	11	10	9	**8**	7	6½
Phyrgian	24[12]	22	20	18	**16**	14	13	12
Dorian	22[11]	20	18	**16**	14	13	12	11
Hypolydian	20[10]	18	**16**	14	13	12	11	10
Hypophrygian	18[9]	**16**	15	13	12	11	10	9
Hypodorian	**16[8]**	14	13	12	11	10	9	**8**

Figure 2: The modes in spatial location on a monochord

14	13	12	11	10	9	8	7			[4]		[2]	[1]										
13	12	11	10	9	8	7			[4]		[2]	[1]											
24		22		20		18		16		14	13	12								]4[		[2]	[1]
22		20		18		16		14	13	12	11							[4]		[2]	]1[		
20		18		16		14	13	12	11	10						[4]		[2]	[1]				
18		16	15		13	12	11	10	9					[4]		[2]	[1]						
16		14	13	12	11	10	9	8				[4]		[2]	[1]								

These modes are clearly related in a systematic way, and each differs from its immediate neighbor by one, namely by increasing (or decreasing) the number of the division by one (or its double), from 8 to 9 to 10 and so on to 14. These modes are also related in a systematic way by repeating the intervals found in other modes, but always at a different, and never at the same,

[15]The details of Schlesinger's construction and why this or that division fits this or that mode are too complex and involved to be given here. The interested reader must consult chapter one of her book.

point in the scale. Hence each scale, as already noted, is *toto caelo* different from every other, despite the systematic similarities.

In order the better to understand these modes and their distinctive interval patterns, one should recall first how intervals expressed in numerical ratios translate into fifths, fourths, thirds, and so on. The translation is as follows.

Figure 3: The intervals as proportions

1:2	octave = medieval diapason or duple interval
2:3	fifth = medieval diapente or sesquialterate interval
3:4	fourth = medieval diatessaron or sesquitertian interval
4:5	major third
5:6	minor third
6:7	septimal minor third
7:8	septimal whole tone or second
8:9	whole tone or second = medieval sesquioctavan interval
9:10	minor whole tone or second
10:11:12:13:14:15	lesser minor whole tones
15:16	semi tone
3:5	major sixth
5:8	minor sixth
7:12	septimal major sixth
8:15	major seventh
9:16	minor seventh
5:9	lesser minor seventh
4:7	septimal minor seventh

Consider next the diagram of Schlesinger's modes but now with the several intervals reduced to their lowest terms so as to make their interpretation clear.

Figure 4: The modes with their intervals in lowest terms

Mixolydian	14	13	12	11	10	9	**8**	7
	7		6		5		**4**	
			4			3		
			3				**2**	
	2							1

Lydian	13	12	11	10	9	**8**	7	6½
		6		5		**4**		
		4			3			
		3				**2**		
	2							1
Phrygian	24	22	20	18	**16**	14	13	12
	12	11	10	9	**8**	7		6
	6		5		**4**			3
	4			3				2
	3				**2**			
	2							1
Dorian	22	20	18	**16**	14	13	12	11
	11	10	9	**8**	7		6	
		5		**4**			3	
			3				2	
	2							1
Hypolydian	20	18	**16**	14	13	12	11	10
	10	9	**8**	7		6		5
	5		**4**			3		
		3				2		
	2							1
Hypophrygian	18	**16**	15	13	12	11	10	9
	9	**8**			6		5	
		4			3			
	6		5		4			3
			3				2	
	3				2			
	2							1
Hypodorian	**16**	14	13	12	11	10	9	**8**
	8	7		6		5		4
				4			3	
	4			3				2
	2							**1**

Each mode spans an octave but only three modes contain two fourths (3:4) that round out the scale (the equivalent of two Aristoxenan tetrachords), namely, the Hypophrygian, the Hypodorian, and the Phrygian. The others contain only one interval of a fourth. The former three, significantly, are the modes singled out by the passage from the *Problems* as not suitable,

or least suitable, to the chorus. The Phrygian, by the way, is the only mode that fully answers to Aristoxenus' requirements, since it is the only one composed of two tetrachords of a fourth joined in the middle by a whole tone. The Hypophrygian and Hypodorian have the whole tone respectively below and above their two fourths. The Hypophrygian, like the Phrygian, has two fifths, but the Hypodorian is distinctive in beginning and ending its octave on *mesē*, or the *archē* of the mode, that is, at the highest and lowest pitches in the mode. This peculiarity will perhaps explain why the *Problems* passage says this mode has a magnificent and steadfast character, because it rounds the whole scale with the principle of the mode.

Now these three modes are the only ones that stand four square on fourths and fifths. The others all surround their single fourth and fifth with thirds and seconds. We may already conjecture, then, that these other modes will not be modes of action because the solid harmonies of fourth and fifth do not round out the scale but fade at either end into the lesser harmonies of thirds and seconds. One will not feel, then, that the mode is moving one on steadily from step to step, but rather that, after a solid step of fourth or fifth, one is stopped with the stutter or weak half-step of third and second. For this same reason, these other modes will lend themselves to melody as the *Problems* passage suggests when it says, "Is it because these *harmoniai* have the least melody, which is most necessary to the chorus?" For since they will not find themselves coming back so often and so easily to fourths and fifths, they will more freely range over other and varying intervals. Hence they will move one rather to notice melody than to act.

Why, however, should the Phrygian be inspirational and Bacchic? Well it is, by standing four square on fourths and fifths, certainly a mode of action, but why a mode of inspirational or Bacchic action? Perhaps because it is the only one of the three modes of action that has the whole tone (8:9) in the middle of the scale. Hence, as one descends, instead of beginning or

ending with a whole tone (8:9) that rounds out or resolves a fourth with a fifth, one begins or ends with lesser minor whole tones (11:12, 12:13) that do not thus round out or resolve fourths with fifths. So one feels the need to keep going and looking further for resolution and not finding it, thus becoming more and more frenzied. These lesser minor whole tones in the case of the Hypodorian and Hypophrygian modes, by contrast, are safely kept within the bounds of resolved fourths. So these latter modes are active but not Bacchic.

All the other modes, by contrast, because, as already said, they do not stand four square on fourths and fifths, are not modes of action, which will be sufficient to explain what the passage from the *Problems* says about them. But that passage also says that the Mixolydian is most mournful and quiet. Its quietness is evident enough from its not being a mode of action, but its mournfulness can be seen from something Schlesinger particularly draws attention to. The Mixolydian is the only one of the modes that descends in equal steps downwards without skipping over any steps. As Schlesinger says of this mode (1939, 136):

> In the descending modal scale [i.e. from right to left in figures 1 and 2 above] or in a melodic use of the Mixolydian modal sequence . . . the grief deepens into an atmosphere of gloom and depression which becomes well-nigh intolerable as the melos sinks by slow steps from the *mesē* through the second tetrachord . . . to the tonic [sc. the lowest note in the mode].

One may think that Schlesinger is over dramatizing, but in her defense one should also note, as does she, that the Mixolydian has *mesē*, or the *archē* of the mode, at the highest point in the scale of all the modes, that is, the note marked in bold in figures 1 and 2 above is furthest to the right in this mode (save for Hypodorian which, as remarked above, is distinctive in having *mesē* at both ends of the mode, at the highest and lowest pitch, and so no more has a high center than a

low center), giving to the mode a distinctive high pitch center, and mournfulness or weeping is not seldom expressed by heightened pitch (cf. *Pr*. 11.50).

One final point concerns the Dorian mode, which, while not mentioned in the *Problems* passage, is regularly associated by Plato and Aristotle with moderation and firmness. That it is not a mode of action will help explain its firmness (it will not prompt to motion). Its firmness can also be explained by its having its *mesē* nearest the center. The Phrygian also has its *mesē* nearest the center but it is a mode of action and, as has been explained, a mode of Bacchic action; so it is not steady. The Dorian is also in the middle of all the modes in terms of number of divisions for constructing the notes (11 being midway between 8 and 14), and so neither rises as high nor sinks as low in proceeding from *mesē* as the others do. It keeps the mean, as it were, of feeling and action, and so is suitably associated with moderation.

Doubtless if one explored the modes further, and especially if one listened to them on properly constructed instruments, one could come up with further evidence to support the above claims. But what has been said here should, one hopes, be enough to show that the passage from the *Problems* with which this paper began makes very good sense when analyzed in the light of Schlesinger's excellent work on the Greek musical modes.

Bibliography

Anderson, Warren D. 1966. *Ethos and Education in Greek Music.* Cambridge: Harvard University Press.

Barker, Andrew. 1989. *Greek Musical Writings*, vol. 2: *Harmonic and Acoustic Theory*. Cambridge: Cambridge University Press.

____________. 2007. *The Science of Harmonics in Classical Greece.* Cambridge: Cambridge University Press.

Jan, Carolus. 1895. *Musici Scriptores Graeci*. Leipzig: Teubner

Lippman, Edward. 1975. *Musical Thought in Ancient Greece.* New York, Da Capo Press.

Mayhew, Robert. 2011. *Aristotle: Problems*, vol. 1: *Books 1-19*. Cambridge: Harvard University Press.

Schlesinger, Kathleen. 1939. *The Greek Aulos*. London: Methuen.

Wallace, Robert. 2005. "Performing Damon's *Harmoniai*." In *Ancient Greek Music in Performance*, edited by Stefan Hagel and Christine Harrauer, 148-56. Vienna: Verlag der Österriechischen Akademie der Wissenschaften.

West, M. L. 1992. *Ancient Greek Music*. Oxford: Oxford University Press.

I'll mention these for what they are worth (as *Pr*. 19 is one of the few books to have received a great deal of scholarly attention [though not much of it is recent]). Some are available via google books.

E.F. Bojesen, *De problematis Aristotelis scripsit et sectionem XIX commentario instruxit* (Copenhagen, 1836)
M.P.G. de Chabanon, *Mémoires sur la Problèmes d'Aristote Concernant la Musique* (Paris, 1779)
E. d'Eichtal and T. Reinach, "Notes sur les problèmes musicaux attribués à Aristote," *Revue des études grecques* 5 (1892)
F.A. Gevaert & J.C. Vollgraff, *Les Problèmes Musicaux d'Aristote* (Ghent, 1903)
E. Graf, *De Graecorum veterum re musica* (Marburg, 1889)
C. von Jan, *Musici scriptores Graeci* (Leipzig,1895)
G. Marenghi, *Aristotele: Problemi di Musicali* (Florence, 1957)
H. Richards, *Aristotelica* (London, 1915)
C. Stumpf, *Die pseudo-arist. Probleme über Musik* (Berlin, 1896)

The following is also worth looking into:

Flashar = H. Flashar, *Aristoteles: Problemata Physica—Aristoteles Werke in Deutscher Übersetzung Herausgegaben von E. Grumach*, vol. 19 (Berlin, 1962)